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Quebec Region

Canadian Science Advisory Secretariat
Science Advisory Report 2015/031

ASSESSMENT OF THE STIMPSON'S SURFCLAM STOCKS OF QUEBEC COASTAL WATERS IN 2014

Source: DFO, 2011.

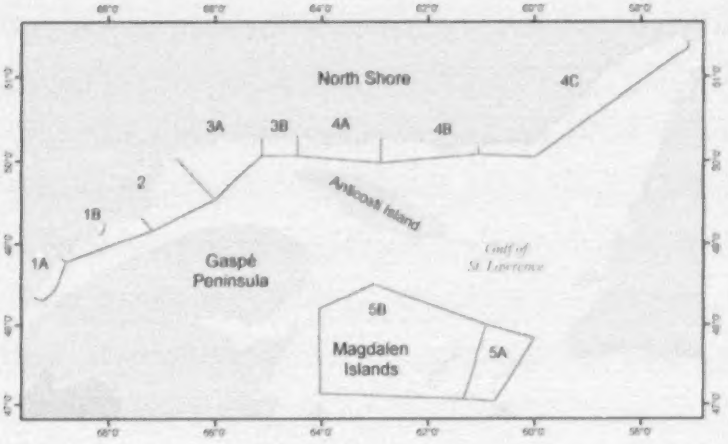

Figure 1. Stimpson's Surfclam fishing areas in Quebec.

Context

Stimpson's Surfclam (Mactromeris polynyma) fishing is a recent activity in the Gulf of St. Lawrence. The most significant beds are mainly located on the North Shore of Quebec as well as in the Magdalen Islands area. Stimpson's Surfclam fishing is conducted inshore using hydraulic dredges, on sandy substrates located 10 to 30 m deep.

Quebec waters are divided into 10 fishing areas to which access is limited to a restricted number of fishers. The effort is also controlled by a fishing season and catches are limited by quota. Until now, the adjustment of the quotas was done with caution due to the slow growth and the sedentariness of this mollusc.

Resource assessment is made every three years in order to determine if the changes that have occurred in the status of the resource justify adjustments to the conservation approach and management plan. The main indicators used in this assessment are derived from landing, logbook and commercial catch sampling data.

This Science Advisory Report is from the March 11, 2015 meeting on the Assessment of the Stimpson's surfclam fishery in the Quebec's inshore waters. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada Science Advisory Schedule as they become available.

SUMMARY

- Mean annual Stimpson's Surfclam landings in Quebec totalled 812 t from 2012 to 2014, an 8% decrease compared with the 2009-2011 period. 90% of the landings were from the North Shore and 10% from the Magdalen Islands.
- On average, over 80% of the annual total allowable catch (TAC) was reached in areas 3A, 3B and 4B. There was no fishery in Area 1A in 2014 and in 1B in 2013 and 2014. Areas 4C and 5A were not exploited.
- Mean catches per unit effort (CPUE) and sizes of surfclams landed from 2012 to 2014 were above the time series medians for areas 1B, 3A and 3B, but below them for Areas 2, 4A and 5B. For Areas 1A and 4B, CPUEs were below and sizes were above the series medians.
- Until now, throughout each area, fishers were able to maintain good yields by moving over a same bed or from one bed to another.
- The zonal exploitation rate based on the dredged surface area is above the recommended limit value of 3% in Areas 3A (3.4%), 4B (3.8%) and 5B (4.8%). In addition, in the other areas, this rate was over 3% for some beds.
- According to the existing decision rule, only Area 3B meets all the conditions for a quota increase of 6%.
- For Areas 4A and 5B, the indicators suggest that local fishing effort is too high.
- As a precautionary measure, portions of beds with concentrations of pre-commercial size (80 mm) surfclams should be protected from the fishery given the species' low productivity. In addition, the fishing effort in one area should be distributed between beds in that area to limit the exploitation rate locally.

INTRODUCTION

Species Biology

Stimpson's surfclam (*Mactromeris polynyma)* is an endobenthic sedentary bivalve mollusc that lives buried in sediments. Surfclams gather in "beds" in sandy sediments on the sublittoral zone or under the low tide line. They rarely move voluntarily. When surfclams are dislodged from sediments, either by currents, waves or fishing gear, they are able to rebury themselves. They are a powerful and active burrowing species, and their burying depth depends on the length of their siphon and consequently their size. They use their in-current siphon to feed, filtering small organisms suspended in water.

On the North Shore, surfclams have been observed at depths ranging between 1 and 46 m. The distribution of beds in this region is closely related to the mouths of large rivers. In the Magdalen Islands, they can be found at depths ranging from 25 to 60 m. They also occur in low densities in certain areas in the Lower St. Lawrence and on the north shore of the Gaspé Peninsula (Figure 2). On a larger scale, Stimpson's Surfclams can be found along the west coast of the Atlantic, from Baffin Island to Rhode Island. They are also found on the Pacific coast, from Alaska to Vancouver Island as well as on the east coast of Russia.

Stimpson's Surfclams have a slow growth and a significant lifespan. On the North Shore, they require between 13 and 16 years to reach their legal size of 80 mm (anteroposterior length) and more than 20 years in the Magdalen Islands. The mean size of surfclams harvested on the North Shore and the Magdalen Islands is around 110 and 100 mm respectively, which would represent individuals of at least

25 years of age. The largest specimens collected on the North Shore (150 mm) and in the Magdalen Islands (130 mm) could be more than 75 years of age.

Sexes are separate and size at sexual maturity would be around 60 mm, which represents around nine years of age. Surfclams are therefore able to reproduce a few years before being recruited to the fishery. However, size at sexual maturity may vary according to the sex and fishing area. Reproduction is synchronous and fertilization occurs in the water column. In the Middle North Shore, spawning would occur primarily from late June to late July. In certain sectors, there could also be a second spawning period later in the fall. After eggs hatch, a pelagic larval stage extending over a few weeks precedes benthic life.

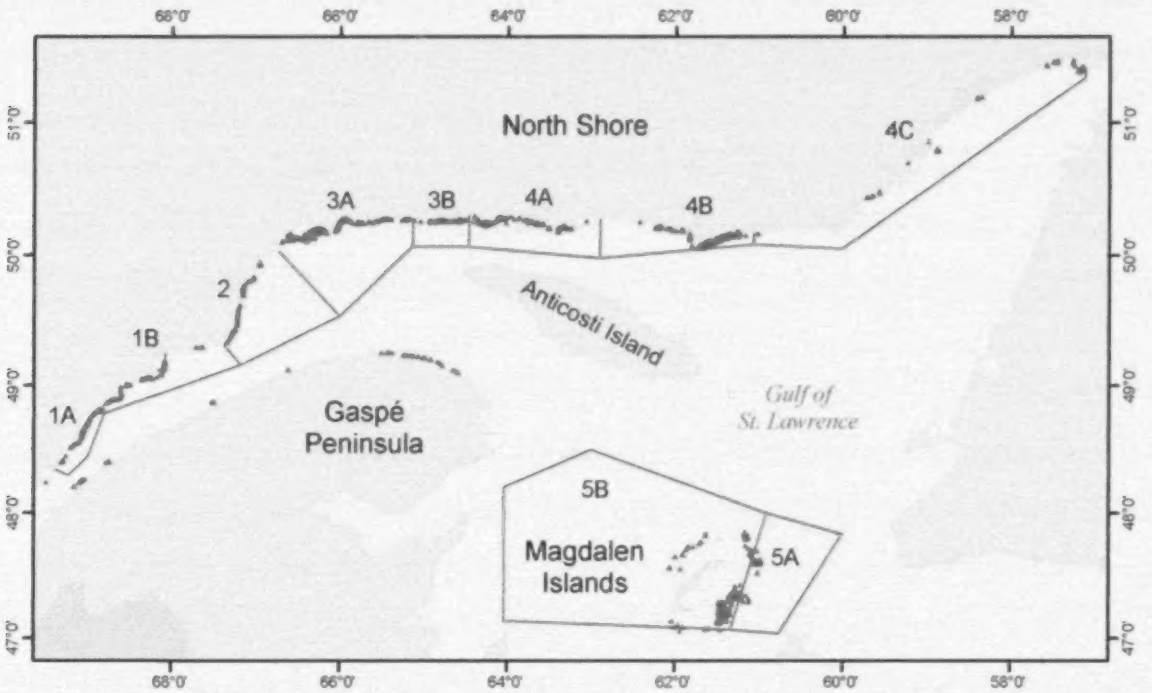

Figure 2. Known distribution (purple triangles) for Stimpson's Surfclam in Quebec.

Description of the Fishery

The first exploratory fisheries in the northern Gulf of St Lawrence were conducted in 1990 in response to interest expressed by fishers and industry. Beginning in 1993, the fishery developed on the North Shore and in the Magdalen Islands and annual landings from these two sectors fluctuated between 200 and 500 t until 2002 (Figure 3). In 2003, fishers began harvesting in Area 4B and annual landings have since increased to approximately 850–900 t, except in 2007, 2008 and 2012, when they were lower. The Stimpson's Surfclam fishery requires the use of a hydraulic dredge. This dredge is designed to be extremely effective, with a low by-catch rate, and to retain only a few undersized surfclams. The dredge typically used in Quebec is the New England model, whose basket is between 1.22 and 2.13 m wide by 1.83 m long. The basket must have parallel stems with spacing of at least 3.175 cm. The effectiveness of this type of dredge was estimated at more than 90% for surfclams measuring more than 80 mm.

In Quebec, the Stimpson's Surfclam fishery is complementary, which means that fishers practice other fisheries during the year. The region has 10 fishing areas, eight on the North Shore and two in the

Magdalen Islands (Figure 1). This inshore fishery is managed throughout the area by the number of licenses, a fishing season, quotas and a minimum catch size of 80 mm (Table 1). In 2014, fifteen permanent licenses and three exploratory licenses were issued. Some licenses can give access to more than one fishing area.

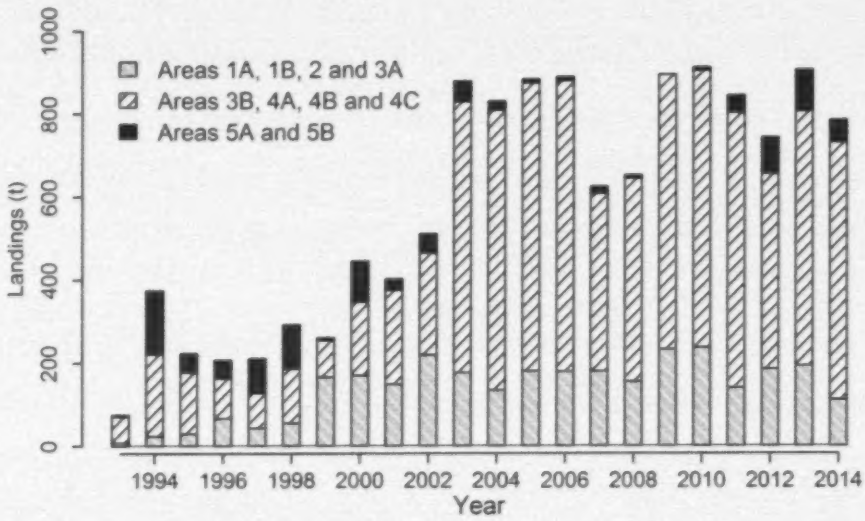

Figure 3. Annual Stimpson's Surfclam landings in Quebec per fishing area.

Table 1. Management measures for Stimpson's Surfclam in 2014.

Management measures	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
Number of licences	1	1	4	2	2	2	5	3[1]	4	4
TAC (t)	80.0	68.6	54.9	80.4	88.4	174.5	425.0	171.1	204.0	113.0
TAC[2] management	ITQ	ITQ	Comp.	ITQ	ITQ	ITQ	Comp.	Comp.	Comp.	Comp.
Start of fishing season	30/06	14/07	30/06	30/06	30/06	30/06	09/06	22/07	24/03	24/03
End of fishing season	31/10	14/10	13/11	10/11	10/11	10/11	02/11	18/10	31/12	31/12
Hail-in	100%							0%	100%	
Number of dredges	1									
Dredge width	1.83 m								2.13 m	
Stem spacing	3.175 cm									
Minimum size	80 mm									

[1] = *Exploratory licence*
[2] = *Comp. (competitive fishing), ITQ (individual transferable quota with restriction)*

ASSESSMENT

The assessment of the Stimpson's Surfclam stock status is mostly based on analysis of commercial fishery data. These data come from three different sources of information; purchase slip, fisher's daily logbook and samples of commercial catches collected dockside by Fisheries and Oceans Canada

(DFO). Scientific surveys and exploratory fisheries enhance information regarding species' distribution and population dynamics.

Stimpson's Surfclam landings are expressed in tons, live weight, or the whole surfclam. Mean landings over the last three years totalled 812 t, down 8% compared with the 2009-2011 period (Figure 3). This decrease is due to fishing inactivity in Area 1A in 2014 and in Area 1B in 2013 and 2014. Between 2012 and 2014, 90% of the landings were from the North Shore and 10% from the Magdalen Islands. On average, over 80% of the annual TAC for the 2012–2014 period was reached in Areas 3A, 3B and 4B. For Areas 1A, 1B, 2, 4A and 5B, the TAC was not reached. Areas 4C and 5A were not exploited.

The mean catches per unit effort (CPUE) for the 2012-2014 period were above the time series medians for Areas 1B, 3A and 3B, but below the series median for Areas 1A, 2, 4A, 4B and 5B (Table 2). Until now, throughout each area, fishers were able to maintain good yields by moving over a same bed or from one bed to another. On a small scale, it is assumed that the effect of the fishery is likely to translate into a decrease in density and mean size and, consequently, the CPUE.

Mean sizes of landed surfclams are high in all areas compared to the legal size of 80 mm. The average sizes for the 2012-2014 period are above the time series median for Areas 1A, 1B, 3A, 3B and 4B, but below the series median for Areas 2, 4A and 5B (Table 3). For most areas, fishers were able to maintain high sizes by moving their fishing effort. The number of individuals measuring less than 80 mm in the landings is negligible (under 1 %) since 2009 due to the dredge's selectivity.

Table 2. Catches per unit of effort (kg per tow for a 1-m wide tow) estimated using logbook data.

Year	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2009	158	132	128	103	183	172	125	–	–	–
2010	146	145	104	89	173	150	107	–	–	39
2011	148	114	–	76	169	151	119	–	–	58
2012	134	95	–	101	151	131	108	–	–	48
2013	122	–	87	120	157	135	97	–	–	58
2014	–	–	95	147	215	157	109	–	–	58
Mean $_{2012-2014}$	128.0	95.3	91.0	122.4	174.0	141.0	104.6	–	–	54.7
Median $_{1993-2013}$	133.7	80.0	97.8	77.0	143.2	150.9	108.5	–	–	56.7

Table 3. Mean size (mm) of Stimpson's Surfclams at landing.

Year	Fishing area									
	1A	1B	2	3A	3B	4A	4B	4C	5A	5B
2009	110	117	115	116	117	114	100	–	–	–
2010	119	113	116	111	115	116	107	–	–	–
2011	117	117	–	107	115	117	105	–	–	–
2012	117	118	–	107	113	114	104	–	–	97
2013	115	–	113	108	109	112	106	–	–	99
2014	–	–	113	109	112	108	108	–	–	94
Mean $_{2012-2014}$	116.3	118.4	113.2	108.4	111.5	111.4	106.0	–	–	96.7
Median $_{1993-2013}$	113.3	105.9	113.5	108.2	111.1	112.4	104.0	–	–	98.9

An exploitation rate indicator was developed for the primary beds harvested during the review of the 2009 to 2011 seasons. Using the same approach, the surface portion of the bed that is exploited was

calculated using daily fishing positions recorded in the logbooks between 1993 and 2014. This area circumscribes 95% of fishing effort during the reference period. The area annually dredged per bed was then calculated by multiplying the number of tows by the average duration of a tow, the width of the dredge, and vessel speed. The exploitation rate for a given year was calculated by area as the ratio between the portion dredged and the harvested portion for all beds in the area. The estimated exploitation rate does not account for possible dredge tow overlapping and that a bed's harvested area could be larger than what is currently measured.

The mean exploitation rate for 2012-2014 in each area was above the recommended limit value of 3% in Areas 3A (3.4%), 4B (3.8%) and 5B (4.8%), but below it for the other areas (Table 4). Although exploitation rates are lower than the recommended limit value across most areas, they may be higher in certain beds: Les Escoumins, Area 1A (8.6%); western Moisie River, Area 3A (5.1%); eastern Tonnerre River, Area 3B (4.7%); central Baie-Trinité, Area 2 (4.6%); Bird Rock, Area 5B (4.2%); Natashquan, Area 4B (3.8%); Cap Colombier, Area 1B (3.4%); Longue-Pointe-de-Mingan, Area 4A (3.2%). Such exploitation rates may not be sustainable in the long term.

Table 4. Stimpson's Surfclam bed surface area, dredged area and mean exploitation rates from 2012 to 2014.

Fishing area	Bed surface area (km^2)	Bed exploited surface area (km^2)	Dredged surface area (km^2)		Exploitation rate 2012–2014 (%)
			Total 1993–2014	Annual average 2012–2014	
1A	17.015	4.801	0.948	0.047	0.99
1B	13.639	2.795	0.653	0.016	0.57
2	28.382	2.827	0.629	0.059	2.09
3A	28.415	3.324	1.432	0.113	3.41
3B	16.481	3.921	1.169	0.086	2.19
4A	17.966	3.894	2.090	0.109	2.79
4B	67.889	10.327	4.829	0.394	3.82
4C	3.217	0.000	0.002	0.000	0.00
5A	20.302	0.000	0.055	0.000	0.00
5B	438.479	3.590	1.753	0.171	4.76

For the bed in Areas 4A and 5B, the indicators suggest that the local fishing effort is too high. Most of the fishing effort in Area 4A occurs on the Longue-Pointe-de-Mingan bed. When harvesting began In Area 5B in the Magdalen Islands, effort was concentrated on the Bird Rock bed. A rapid drop in CPUE was observed. From 2004 to 2011, the fishing effort was low on this bed and other beds were exploited. However, since 2012, the effort has been refocused mainly on the Bird Rock bed. For these two areas (4A and 5B), the mean CPUE and sizes for the 2012-2014 period are below their respective time series medians. In addition, the exploitation rate for these two beds is above the recommended limit value of 3%.

Research surveys conducted on the North Shore in 2009 and 2010 as part of the Fisheries Science Collaborative Program showed a very localized presence of high densities of surfclams measuring less than 80 mm in the Longue-Pointe-de-Mingan (Area 4A) and Natashquan (Area 4B) beds and lower densities in the Forestville (Area 1A) bed. Furthermore, commercial size surfclams were more evenly distributed within these beds compared to pre-commercial size surfclams (< 80 mm). As a precautionary measure, portions of beds with concentrations of pre-commercial size (80 mm) surfclams should be protected from the fishery given the species' low productivity.

Ecosystem Considerations

Dredges used for harvesting Stimpson's Surfclams have an immediate impact on substrate and benthic organisms, as they liquefy the sediment up to 20 cm deep to collect most of the larger organisms and cause sedimentation adjacent to the dredge's path. The recovery speed of benthic communities that are

affected would vary depending on the site's depth, sediment type and degree of hydrodynamics. Shallower sites with higher hydrodynamics produced by waves or currents seem to recover their initial state of sediment compaction and faunal composition between a few days to a few months after the dredge has passed. This rapid recovery is potentially caused by the fact that the high hydrodynamics and natural instability of sandy bottoms helps communities more resilient to disturbance. However, there are some uncertainties about the effect of dredging on benthic productivity in general.

Fishing effort is not distributed uniformly in the surfclam's known habitat. Fishermen prefer to frequent portions of a bed with high concentrations of surfclams. The annual average surface area dredged from 2012 to 2014 totalled 0.824 km^2 on the North Shore and 0.171 km^2 in the Magdalen Islands. The total area dredged since the beginning of the fishery in 1993 is about 11.8 km^2 on the North Shore and 1.8 km^2 in the Magdalen Islands. The footprint of the fishery on this habitat is relatively small compared to the surface areas of known beds, 193 km^2 on the North Shore and 459 km^2 in the Magdalen Islands, and represents about 6% and 0.3 % of the known habitat of surfclams on the North Shore and the Magdalen Islands respectively (Table 4).

Sources of Uncertainty

This assessment is based primarily on indices derived using logbook data and commercial capture sampling at dockside. Any change in the fishing technique (e.g., an increase in dredging speed) would have a direct impact on CPUE and exploitation rates. In addition, missing or erroneous georeferenced positions would have an impact on the calculation of the harvested surface portions of the beds and the areas. Independent sources of information are available only for a limited number of beds. With unknown exploitation rates based on exploitable biomass, bed productivity and recruitment, using an empirical approach seems to be the only mean to adjust quotas.

CONCLUSIONS AND ADVICE

Quota increases must be conservative as the surfclam's low growth rate and sedentariness make certain beds vulnerable to overexploitation. According to the guidelines established to recommend quota adjustments in each fishing area, increases should not exceed 6% per 3-year period. A quota cannot be increased unless over 80% of it on average has been reached consistently during the assessment period and the CPUE and mean size indicators are above the time series median. In addition, the exploitation rate in the area should be below 3%.

According to the existing decision rule, only Area 3B meets all the conditions for a quota increase of 6%. The status quo is recommended for all other areas.

OTHER CONSIDERATIONS

Conservation Approach

The objective of the conservation approach for the Stimpson's Surfclam is to protect the reproductive potential and genetic integrity of populations in the Quebec Region, as well as to limit the fishery's impact on the ecosystem.

To achieve this, Quebec is divided into several fishing areas where access is limited (number of fishers, fishing season and TAC). In most fishing areas, there are also closed shellfish areas. These closed areas protect a certain portion of the surfclam population from harvesting, but its contribution to the reproductive effort remains unknown. The density of spawners is critical for reproductive success and protecting small areas with a high density of adults may be beneficial for the population. In addition, portions of beds with a high density of pre-commercial size (< 80 mm) surfclams should be protected

from the fishery because they are less evenly distributed within the beds compared to commercial size surfclams. The exploitation rate must remain low given their low productivity.

Most surfclams are mature at 60 mm, but the contribution of smaller surfclams to the population's reproductive effort is relatively low (proportional to individuals' size). The current minimum catch size of 80 mm allows individuals to reproduce a few years before being vulnerable to the fishery. In addition, the spacing of the dredge's stems minimizes the harvesting of surfclams smaller than 80 mm.

The impact of the fishery on habitat is limited, as are by-catches, due to the hydraulic dredge, which is very effective in minimizing the fishing effort required to reach the TAC. In addition, this highly selective dredge collects only commercial size surfclams and by-catches are very low.

SOURCES OF INFORMATION

This Science Advisory Report is from the March 11, 2015 meeting on the Assessment of the Stimpson's surfclam fishery in the Quebec's inshore waters. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada Science Advisory Schedule as they become available.

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Lambert, J. and Goudreau, P. 1995. Performance de la drague hydraulique de type Nouvelle-Angleterre pour la récolte de la mactre de Stimpson (*Mactromeris polynyma*). Can. Tech. Rep. Fish. Aquat. Sci. 235: vii + 28 p.

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ISSN 1919-5087
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Correct Citation for this Publication:

DFO. 2015. Assessment of the Stimpson's surfclam stocks of Quebec coastal waters in 2014. Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/031.

Aussi disponible en français :

MPO. 2015. Évaluation des stocks de mactre de Stimpson des eaux côtières du Québec en 2014. Secr. can. de consult. sci. du MPO, Avis sci. 2015/031.